Supporting Information for the article
"Asynchronous Rate Chaos in Spiking Neuronal Circuits"

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S5 Maximum Lyapunov exponents in the inhibitory LIF rate model

Figure S5A shows histograms of the maximum Lyapunov exponent calculated for different realizations of the network and different values of J_0 (N = 40,000, K = 800, $I_0 = 1$). When J_0 is 0.9, negative Lyapunov exponents are virtually never observed. As J_0 is decreased to 0.7, the center of the distribution shifts below zero, but the distribution is wide enough to observe positive as well as negative Λ's. When J_0 is further decreased to 0.5 the distribution lies mostly in the negative part, but it has a long tail and thus positive Λ can still be observed. When $J_0 = 0.3$ the probability has a long tail toward positive Λ but the fraction of networks there becomes extremely small. These results are summarized in Fig. S5B which plots the fraction of chaotic networks vs. J_0. As a result, for $J_0 < 0.3$, simulations of the network virtually always converge to a fixed point unless the network size is extremely large.

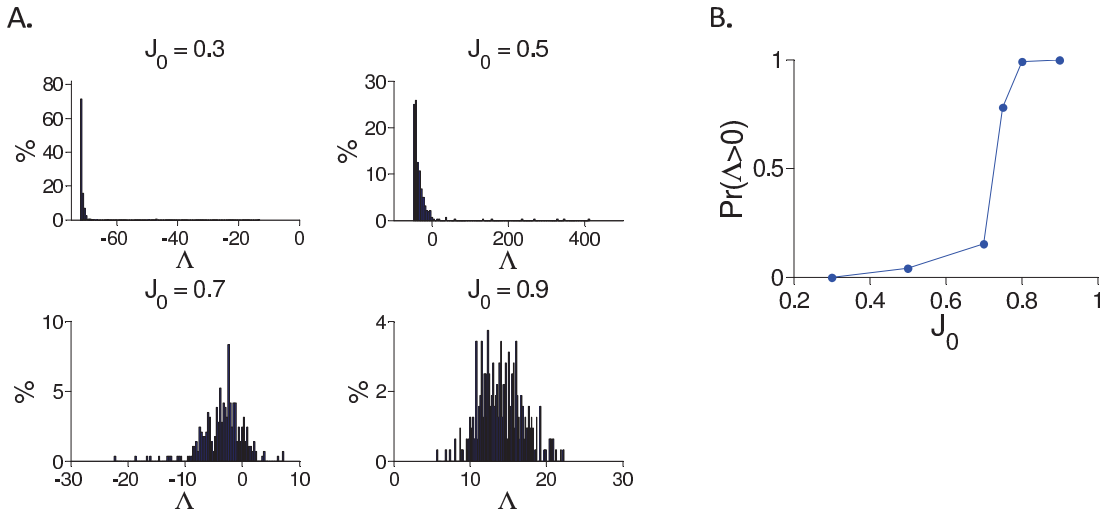

Figure S5: **Lyapunov exponent in simulations of the inhibitory LIF rate model.** Parameters: $N = 40{,}000$, $K = 800$, I_0=1. A: Distributions of the Lyapunov exponent, Λ, calculated over 320 realizations of the network for four values of J_0. B: The fraction of networks with $\Lambda > 0$ is plotted against J_0.